Abstract:

20: this mention of the quality in the abstract is important, but there is not much about quality in the main text: please integrate (e.g. how many data discarded for bad quality in the processing?)

Introduction:

24: in the seek of clarity, I suggest finding a direct qualifier for the “first” and “second” towers, e.g. “with first tower we refer to the sensors deployed and the measurements taken in the pre-ICOS phase, that is from the first installation till the ICOS labelling”.

25: please note Zhao et al. was published in 2026. Please correct here and elsewhere.

31: please shortly mention the main changes required to be labelled

32: what is geographic history?

34-36: I think for CO2 eddy covariance you focus only on the fluxes calculated before the post-processing (no ustar filtering and no gap filling): this is clearly a possibility, but should be stated somewhere, and a reason provided (as this is the ICOS tower, and the data are also centrally processed and post-processed, you may be able to use the final datasets)

37: see comment 32: should be the same or not?

69: the soil was poor for use or in general? because first you mentioned agriculture, and then not suitable for agriculture

77: section 2.4 is air meteo sensors

49,79: consider merging the two figures in the same one

88: WWII. However this is counterintuitive, as in the first period the water table depth was supposed to be closer to the root system, and the acidification was lower… In addition, if the microorganisms were depressed by acidification, what triggered the growth after WWII if also decomposition was slow?

106: was there an impact of Prunus invasion in the tree rings (e.g. competition)?

110: can you show the decrease in of ecosystem respiration?

116: would be nice to see the borders between horizons in the figure. Please also note that the ICOS sampling scheme has not been introduced yet (the reader doesn’t know yet what is an SP)

121: This is a good spot to introduce what was required for the labelling, what are the CP, SPs (so you can refer here in fig.3) etc. with mention of the instruction doc (please note this is not the proper way to cite the ICOS Instructions, see References). And also the fact that AGB is retrieved via allometric equations. In what consisted the tree sampling campaigns?

133: technically not a square…

136: a.o.?

137: based on kml files provided by ICOS ETC?

151: did you count only the shrubs of Prunus only with DBH>5 cm? For this species, did you apply the ICOS protocol for measuring AGB of the understory?

161: if SP-I_05 and 16 are in a less densely populated part of the forest, we should see it in Figure 5, not 6 (true for 16, less for 5). So the trees in SP-I_05 should be smaller than average: is it the case?

180: I am not sure fig. 7 is the best option to visualise diameters distributions. I think a classical histogram with the number of trees in each class could better describe the type of forest

185: then the canopy height is not taken from the soil (i.e. if over a dune, from the top of it)? If so, the fact that it is homogeneous would mean that the trees grew the same in the valleys and in the dunes.

186: the uncertainty is based on SD or SE? If SE, it is much higher than first tower

196: is this also the equation used in ICOS?

200: specie-specific parameters

205: again if you make clear what is pre-ICOS versus what is post-ICOS, you may also add the root biomass

218: without an uncertainty analysis, the comparisons between data taken with different sampling schemes are really difficult to be interpreted. Would it be possible to check for an overlap of sampling points, and use only data that overlap?

221: was dead biomass included in the previous sampling?

223-224: the allometric equations were not the same in the two campaigns? Didn't you make your own equations for ICOS?

Instrumentation:

237: R stands for replicate in ICOS

238: this is not the ICOS standard: if an instrument is replaced, the variable name does not change. If it is added in close proximity, then the index of the replicate is raised.

243: please note current location of ICOS tower from ICOS BADM is: 52.16644722N, 5.74355E, while older tower is reported at 52.166553N, 5.743589E. In the manuscript: Latitude 52.166581 °N and Longitude 5.743556 °E. These are small differences but would be better to be consistent

244: elevation is 33 m in ICOS BADM

251: why radiometers and phenocams together?

253: Kipp & Zonen (here and elsewhere)

263: here and elsewhere: if this is ICOS data the Carbon Portal should be also mentioned

268: (here and elsewhere) what is the purpose of having var names? To retrieve respective location according to the rules explained above? However you have height and distances. And what about the serial numbers?

270: Phenocams are also going to be included soon in the ICOS portfolio

277: it would be great to superimpose fig. S1 with a DEM

278: G is only measured at 5 cm. TS at 1.5 cm and SWC permit the calculation of the storage of G (made by the ETC during the processing)

290-295: I would not only mention the Carbon portal, but also the fact that the ETC is processing this data following the equations reported, and that the meta information needed, as the installation depths, are reported via a standard protocol (BADM)

311: not clear why the below canopy measurements are referred to in here. Indeed, “main” TA and RH do not seem to have been included in any section.

324: “carried” (typo)

325: the forest canopy was previously said to be on average between 15 and 18 m, so the EC system should be around 20 m above it. However, for the purposes of the eddy covariance processing, for which the distances from the “surface” is needed, it is not the average that matters, but something representing the “canopy top”. What we use in ICOS is the 90th percentile of the trees heights sampled, which for NL-Loo is 22 m: in this sense the tower is 16 m above the canopy top.

331: please add something like: "this setup was done by following the ICOS requirements and by discussing with the ICOS ETC, during the labelling phase, the best strategy given the local station characteristics"

333: see above for the serial numbers (but also logger and file ID). On the contrary, more details may be needed on the distances (e.g. from what?) and wind exclusion ranges

337: OK, see above

338: in general: what is the target for the readers community? Are they supposed to know what is a footprint climatology? (z-d)/L? But not for example covariance maximisation method (see lines 459-460)? And: how long of a period has been used to extract this climatology? I think providing a short overview of the theory behind the measurements, and the processing steps could really help the reader

339: “shown” (typo)

348: suggestion: "... as the tower distorts the wind flow and the turbulence field characteristics"

350: please change the section title to something like "Air meteo and profiles", so that you can include also main TA/RH, and justify the presence of measurements above the canopy

351-358: this is a theoretical background, which I think is good to provide, maybe even before (See comment 338). However, I would also mention that such a distance between the sensing system and the canopy is supported by the theory as well, because being too close to the canopy top would mean measuring in the roughness sublayer leading to de-coupling and bad measurements in unstable conditions. Also, stable conditions will be mostly discarded by the ustar filtering during the post-processing

360: not clear in this context what wind speed profile is needed for.

365: this is a theoretical formula: in the practical implementation, the time derivative is approximated by a difference between consecutive measurements, and the integral by the summation of concentrations measured at the different levels, weighted for the heights of the levels. Again, calculations are made at the ETC and the setup was done in accordance to the ICOS requirements

385: the tree top levels are actually above the canopy

394: is this automatised?

408: "...and via the ICOS CP..."

415: good to mention also non-ICOS data, however as already suggested I think it should be made in a more organic way

417: all this section 2.7 could be complemented with some recommendations for potential future deployment of these measurements in ICOS: the expertise of sites already measuring is key for the implementation of new measures.

426: 56 or 50 m?

434: please define what Th stands for. Does this mean masses between 500 and 1000 Th? What does it mean to stay in this range?

449: How is it calibrated?

452: in this section I would mention what differ as compared to CO2 eddy covariance method. From this text it only seems that you apply timelag correction and some kind of spectral corrections, while mentioning that you also detrended w and C. What about for example coordinate rotation and the other corrections commonly applied in EC? See also comment 338

463: please define "optimal"

465-466: not clear how you used the timelag for monoterpenes, and a constant value of 1 s for O3. In general the strategy for time lag is not 100% clear to me, and taking just one halfhour to demonstrate that it is OK it's not that robust

472: being based on a single halfhour only, it doesn't look so general

478: this is not automatic? PWB method from Vitale could be explored (as a future suggestion)

484: what is the meaning of the sign for the lag?

488-489: so there is not a real spectral correction, but just a check that the setup is done in a proper way such as to minimise spectral losses? Why?

491-493: I am wondering if this corresponds to a lower sampling frequency: I understand this should be "worst", however the aim here is to check CO2 behaviour in the case of 2 Hz frequency, so should be done as if it was sampled at 2 Hz

494: however this result is a bit surprising: this basically means that for tall forests and measurement heights we could use a slow response IRGA… Is CO2 behaviour comparable to VOC? Again, only one day and a few halfours may not be enough. Also, the difference is based on visual inspection, while it would be preferred to have some statistics. What about H2O, also reactive?

506: why you didn't select the standard log-log scale for cospectra?

508: why 7.5 s?

514: noise for VOCs starts at 0.04 Hz, except monoterpene that is 0.4 Hz. O3 0.1Hz: can we still talk of “high-frequency” noise?

523: definitely something to study in more detail. All this spectral part is a bit generic, and sounds like something you need to invest on, not yet fully implemented. Which is totally fine, however it should be presented as it is

525: Sabbatini (double B) :) OK for future publications on that, however it is not clear if you already started producing this data or not. Please note that some ICOS processing steps will likely be not applicable as such (e.g. data cleaning)

539: are earlier estimates are not based on DHP, but on LAI2000. Again, comparison should be taken with extreme cautions, and the differences should be highlighted. This may also explain why leaf area is in line (lines 550-551), but not LAI.

550: the results are relative to 2024 and 2025

556: 2024 and 2025. Please note that the sampling strategy described in this caption (10 trees and 15 "foliar samples" per CP) is different from what reported in the text (6 trees per CP, 2-3 twigs per tree for a total of 30 samples and 10 leaves per each sample). Which one is correct? What is prescribed by ICOS Instructions?

556bis: in some cases, adding the findings from Zhao 2026 together with the ones included in the manuscript may help the reader. This is one

574: section 2.9 is mostly on the future, as there is no data yet

585-590: what is the purpose of mentioning what has been done without summarising the results, but only referring the reader to the publication?

Demonstration:

620-646: nice example. I would add NEE (FC+ST) to the plots of fig. 14 for a more straightforward comparison, however by mentioning that no ustar filtering and gapfilling are applied yet at this stage (only for demonstrative purposes). Also, please mention that no data cleaning was applied, and a consideration on the fact that the ustar filtering would remove most of the night data of this example, in particular on the third night. It is also interesting to see this smaller below-canopy accumulation at sunset, when the ustar goes down

625: 0.1-0.2 instead of 0.4?

649-658: as you mention it, please add WS profile plot.

667: fig 14: consider adding (in a separate plot if too crowded) also the storage of T: could it be a proxy for the impact of different T?

674-675: please mention that, despite a slight displacement between the two towers, you expect the footprint to basically overlap and look at the same vegetation patches (this should also be mentioned at the beginning)

676: the diurnal cycles show much agreement "in the 4 days selected". However, only visual comparison may not be sufficient to understand how the diurnal cycles match.

677: why? I think the fact that the storage is different for the two systems would not automatically imply that Fc is different

679: please note qc was not introduced.

684: please also mention that differences may be due to several reasons, like: 1. different position/footprint (hopefully not much); 2. different sensors; 3. different processing (this can be checked)

Outlook:

690: in this section please clearly separate what is already in place and what is target/goal/ambition

700: being part of a research infrastructure will also amplify the impact of the station and likely facilitate the ambitions mentioned above, by providing robustness, standardisation and long-term horizon

702: in the manuscript there is no mention of NOx measurements made in Loobos, only regional estimates. For NH3, two campaigns are mentioned, but it is not clear how long they lasted, and the results of just one are reported (the annual NH3 deposition), as the other one was a test on the setup. Eddy covariance for such gases is challenging, and the effort for making these campaigns is highly valuable: but if you think this represents a milestone for Loobos, probably they deserve more attention in the manuscript?

713: the in-canopy part is more a future target that you have: could you describe your plan in more details?

715: also a goal. This could be also extended to other models to be developed in the future

721: please add a sentence on the fact that the combination of flux data and vegetation characteristics can give a significant contribution in this direction

722: here you could provide more details if this is something peculiar to Loobos, otherwise (or in addition) mention that Loobos, like all the ICOS stations, provide valuable datasets for the calibration and validation of satellite products (also via the NUBICOS project).

726: there is not much info in the manuscript about DTS, only 4 lines mentioning the target of this project: I would merge points 8 and 9 as collaborations and field campaigns where you recap them all

Data availability:

738: please be more specific on which of the data you mentioned above are present in the CP as NRT product (updated daily) with the possibility of plotting the variables; and which ones are available on your webpage (also and only)

748: please mention that the data were downloaded from the CP as indicated in the reference link at line 742

749: please note that this link points to a deprecated version of the L2 dataset: if this is the one you used it is totally fine, but please note that in this case the year of the citation is 2025, not 2026. I think this is the case for all the links of this section, please check them all

References:

849 (here and in the text): this is not the proper way of citing the ICOS Instructions. Each document has its own citation and doi, e.g. "Gielen, B., Iserbyt, A., Op de Beeck, M., Michilsens, F., & Papale, D. (2017). ICOS Ecosystem Instructions for Ancillary Vegetation Measurements in Forest (Version 20260201). ICOS Ecosystem Thematic Centre. https://doi.org/10.18160/4ajs-z4r9".

906-915: please check the links and the year of publication of the datasets

Supplementary:

26: having the 1:1 in figure S.3 line may help the reader to have a better sense of the differences between L2 and NRT agreement. Also, how can R2 in the left plot be equal to 1?